2nd Generation Airborne Precipitation Radar (APR-2)

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Airborne Precipitation Radar (APR-2) - Overview

- Dual-frequency operation with Ku-band (13.4 GHz) and Ka-band (35.6 GHz)
  - Geometry and frequencies chosen to simulate GPM radar
- Measures reflectivity at co- and cross-polarizations, and Doppler
- Range resolution is ~ 60 m
- Horizontal resolution at surface (DC-8 at 11 km altitude) is ~ 1 km

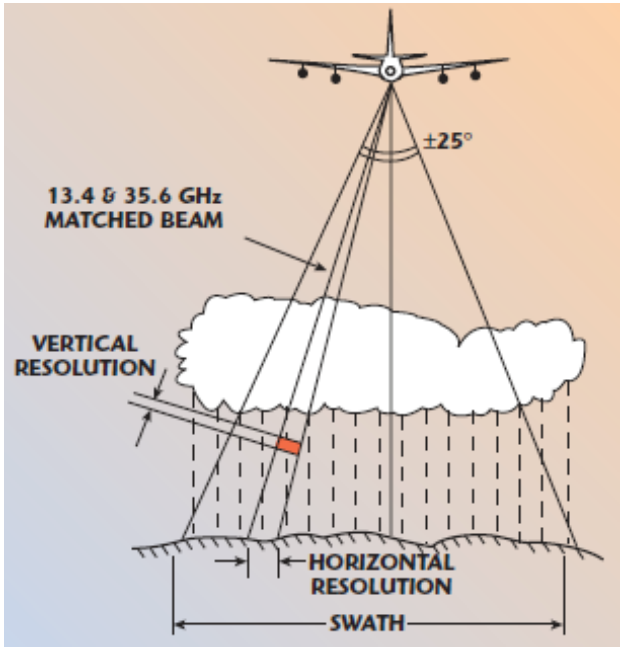
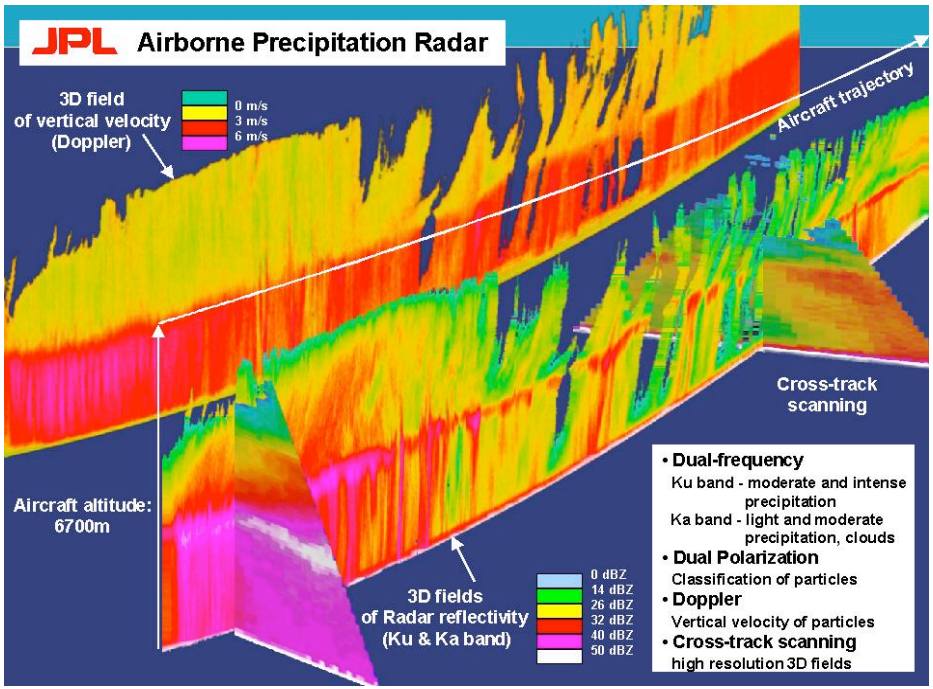


Image below shows 3D nature of APR-2 data; 50-degree data wedge underneath flight track



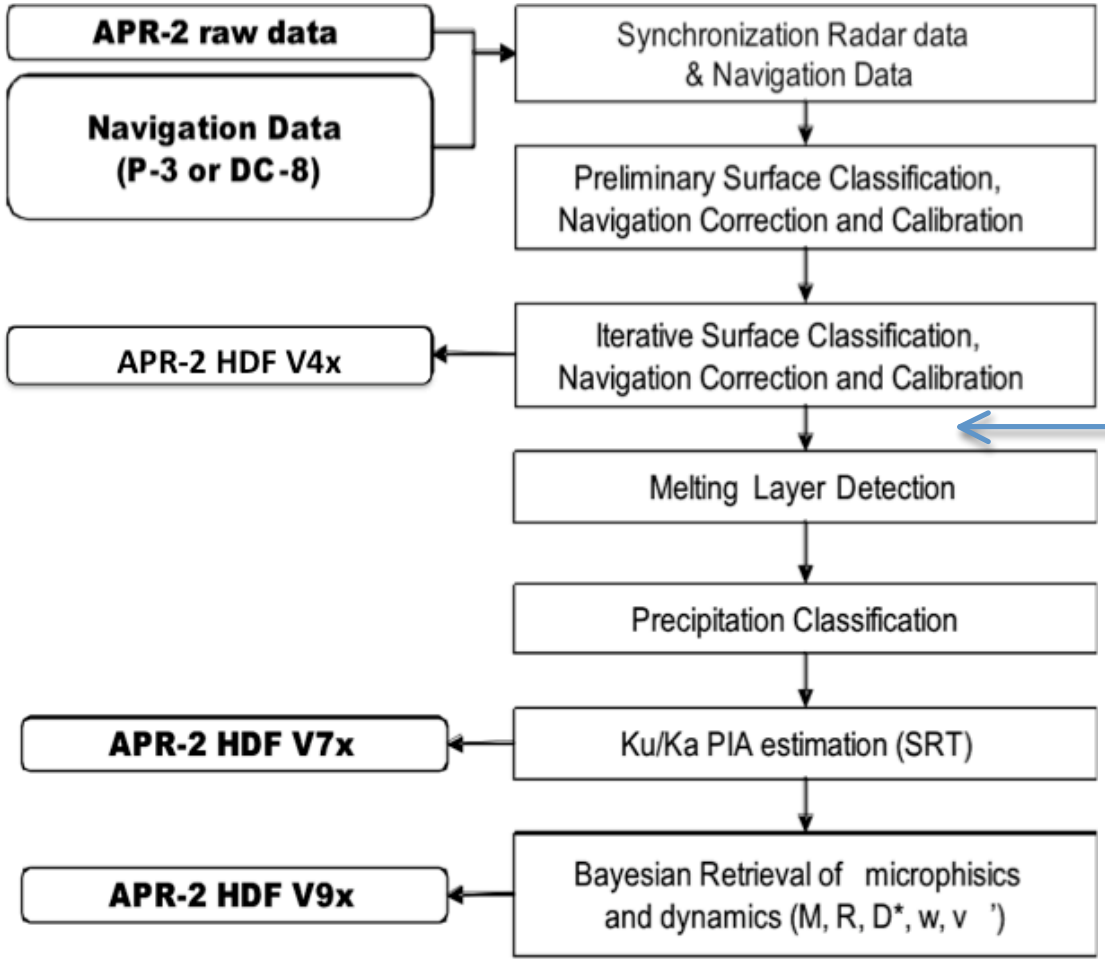
Data Collected During GRIP

- Table below show each day that APR-2 collected science data, along with total duration and storm name, if applicable

Date	Flight No.	Name	Data Vol.	Comments
8/17	6	Ex TD 5	2.0 hr	Melting layer spiral
8/24	7	-	4.8 hr	Multiple passes developing
8/29	9	Earl	4.4 hr	Cat 1 – developing eye
8/30	10	Earl	3.9 hr	Cat 4
9/1	12	Earl	2.5 hr	Cat 4
9/2	13	Earl	4.3 hr	Collapsing eyewall
9/6	15	Gaston	3.8 hr	Convective cell
9/7	16	Gaston	3.9 hr	Stratiform area
9/12	17	PGI44	4.8 hr	Non-developing Karl
9/13	18	PGI44	4.7 hr	Non-developing Karl
9/14	19	PGI44/Karl	2.8 hr	Genesis
9/16	20	Karl	3.8 hr	Emerged from Yucatan
9/17	21	Karl	4.4 hr	Landfall – orographic rain
9/21	23	Pre-Matthew	3.6 hr	A-Train underpass
9/22	24	Pre-Matthew	4.5 hr	A-Train underpass

Post-Experiment Processing

- The flow-chart below illustrates the processing of APR-2 data post-experiment
- Calibrated reflectivities, Doppler have been delivered to archive 5/12

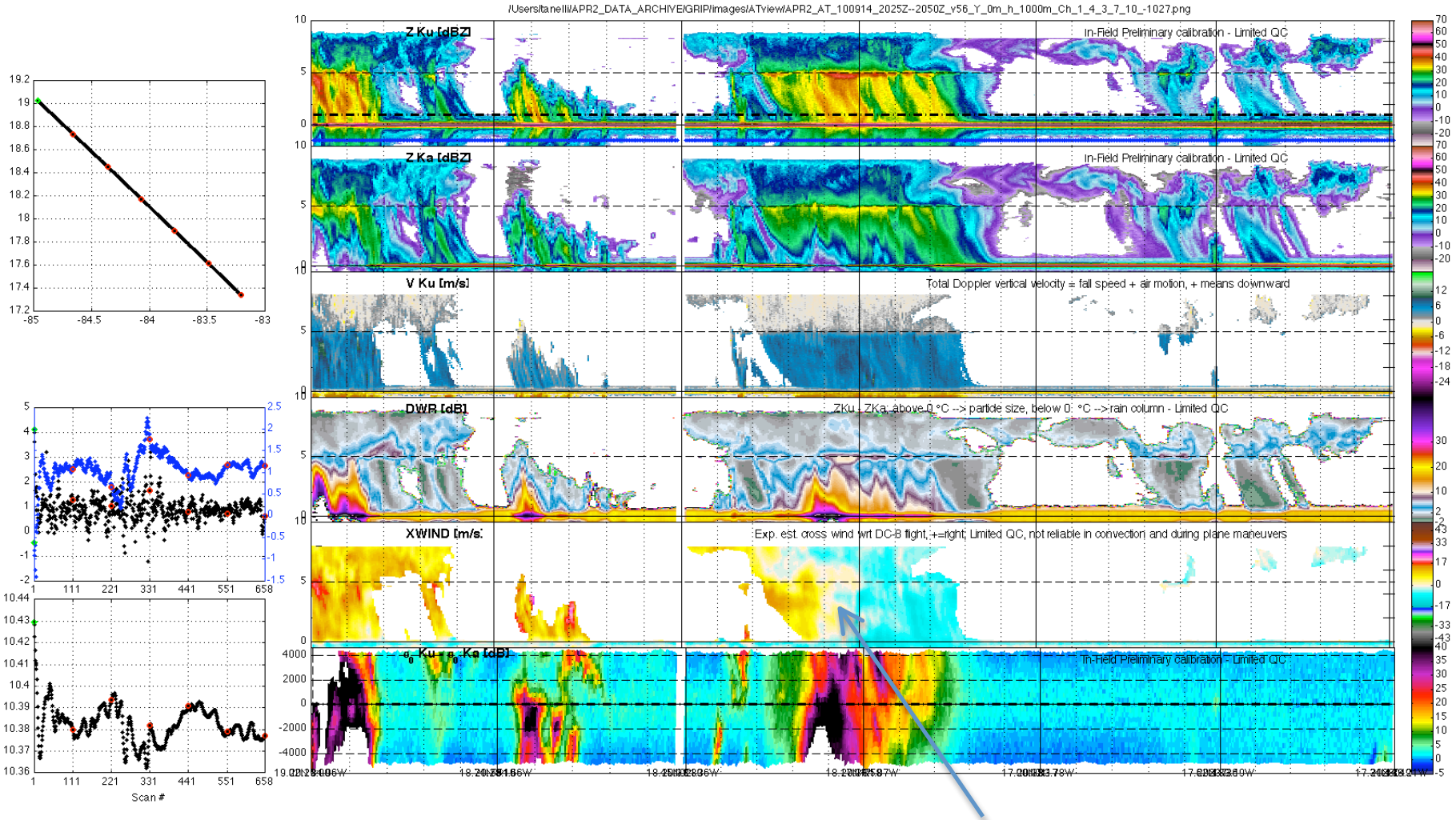


Cal used surface at Ku and light precip at Ka; estimated accuracy +/- 1 dB

Aircraft motion calculation includes MMS data

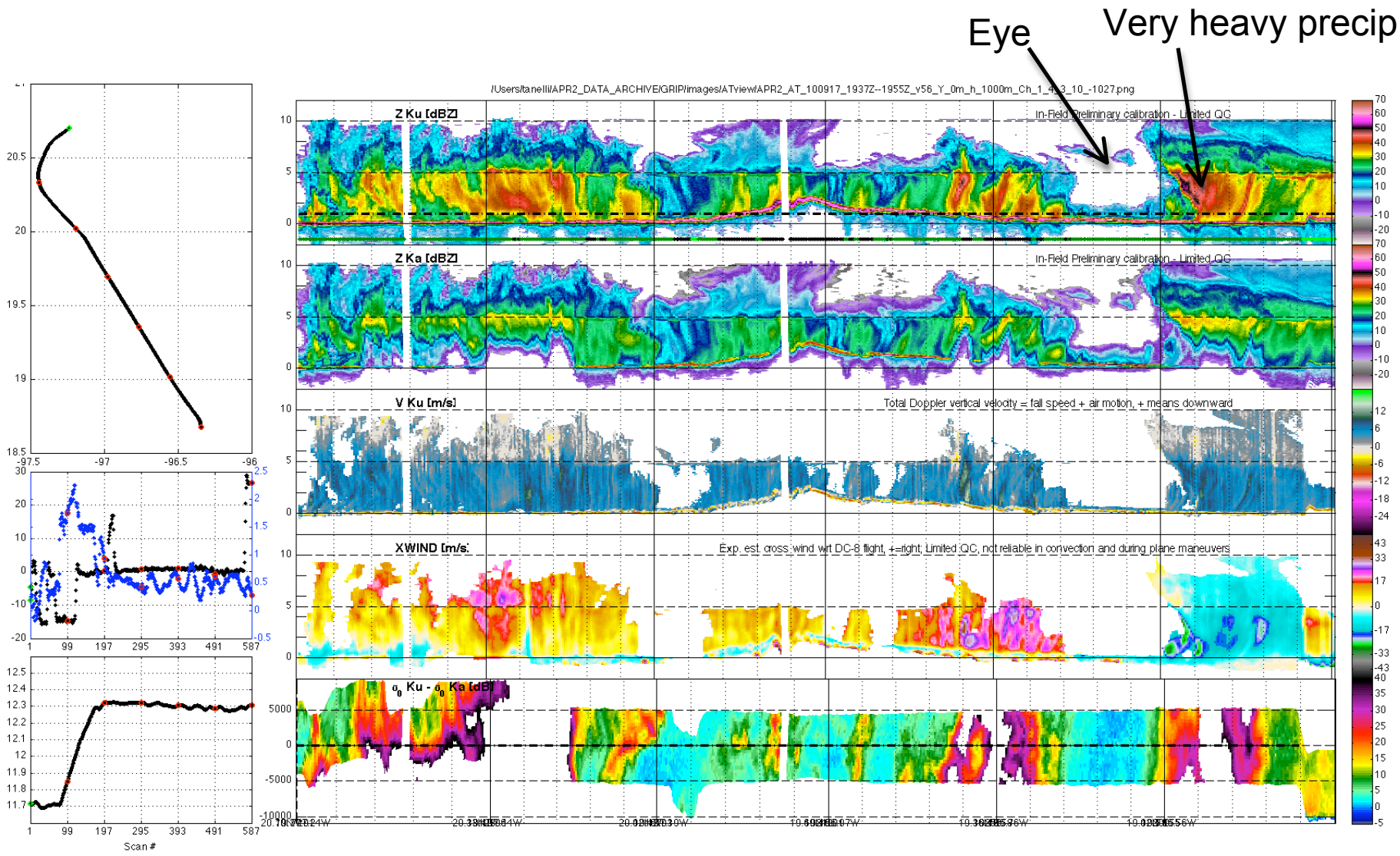
Delivery to archive

Example: Karl Genesis 9/14

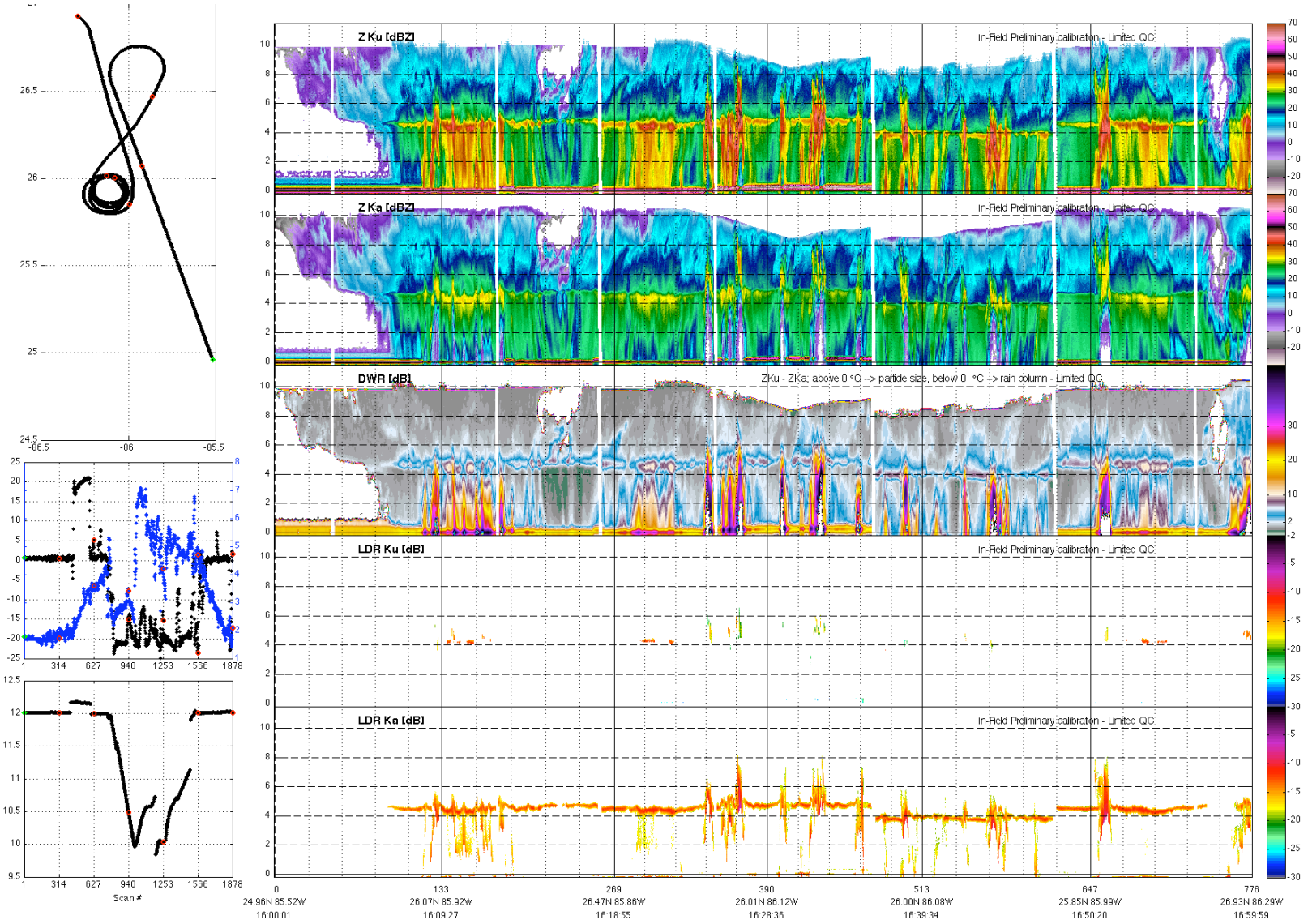


Wind direction shift

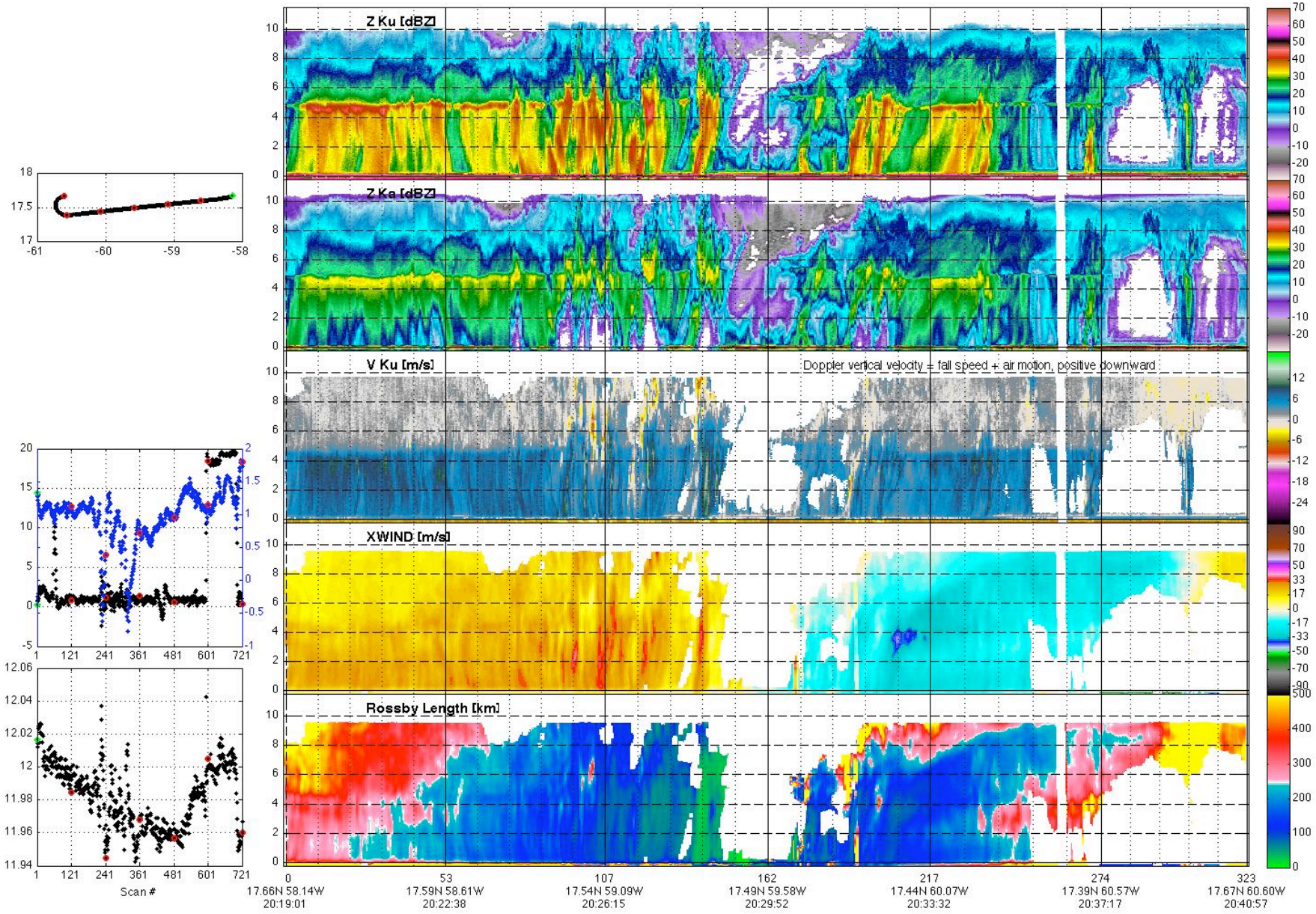
Example: Hurricane Karl At Landfall 9/17



Example: August 24 – Convective Cell Time Series



Hurricane Earl – August 29 – Cat 1

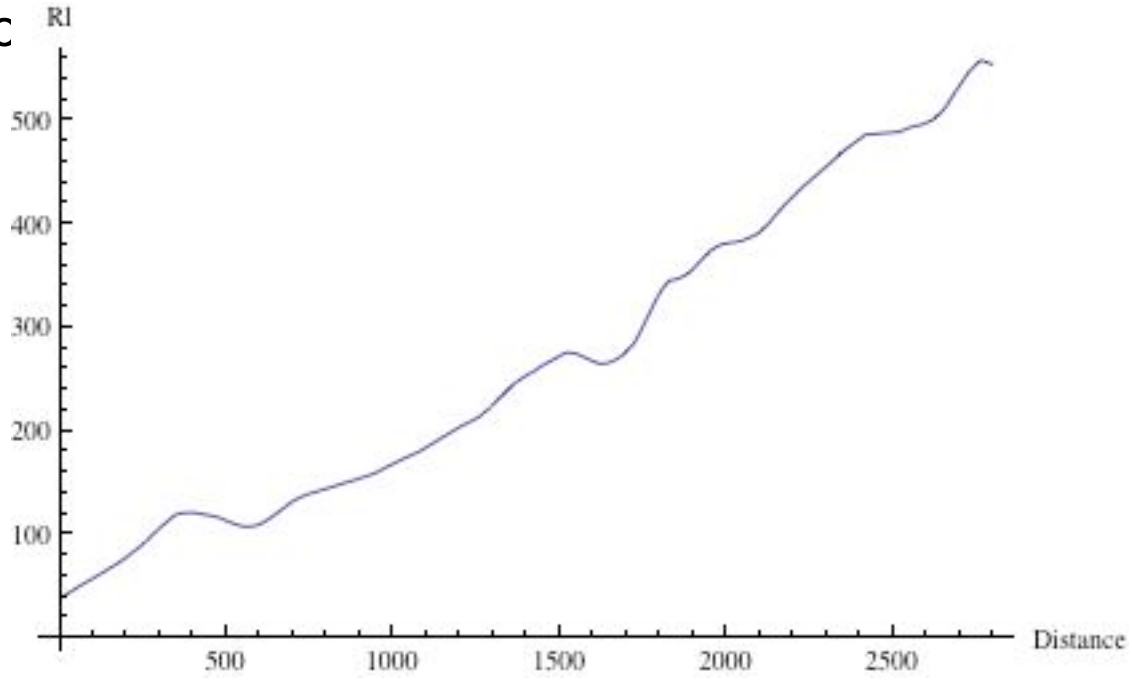


Rossby Length Calculation for Hurricane Lines

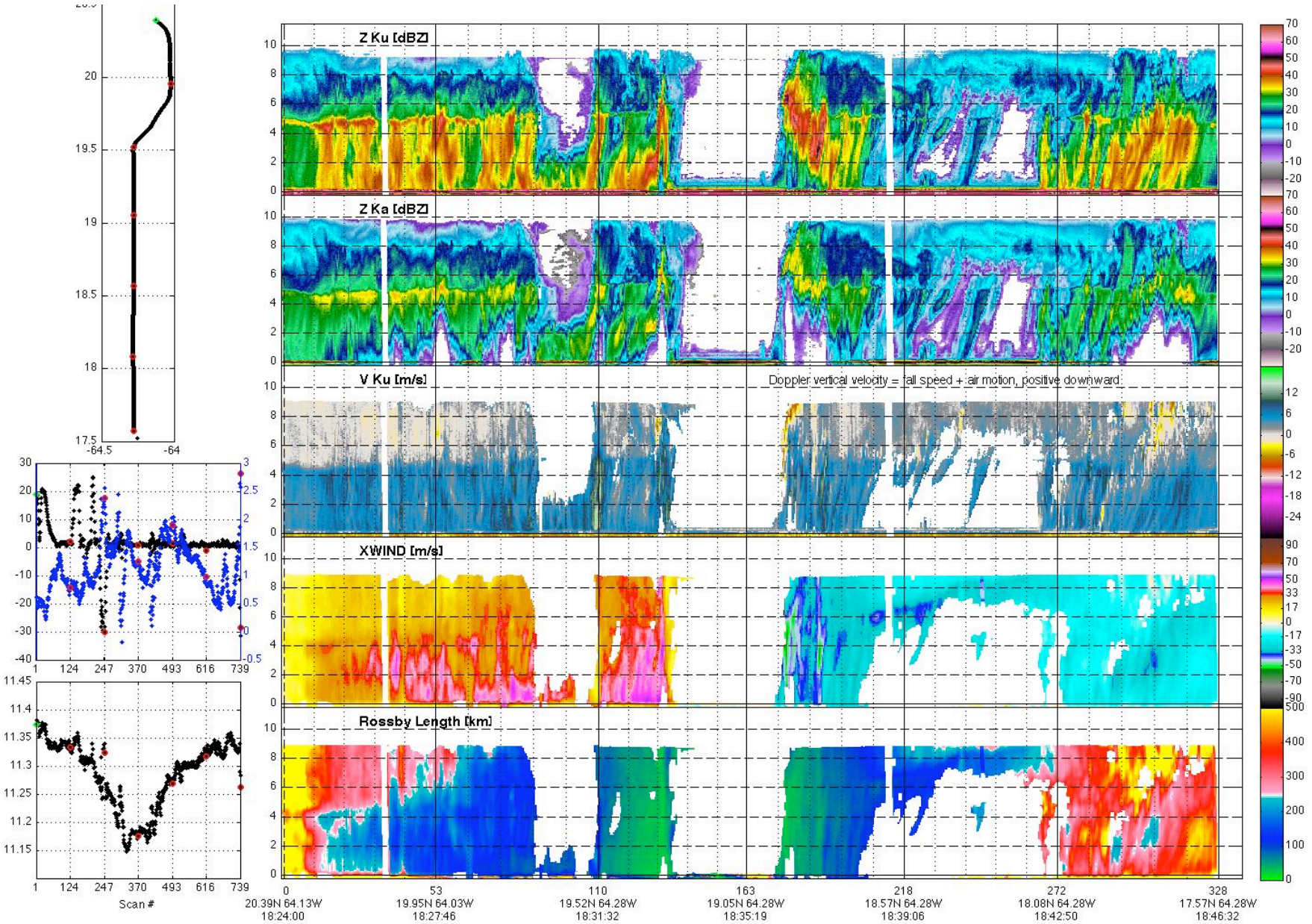
- L is the length scale at which rotational effects become as important as buoyancy effects *L=NH/f* - related to efficiency of convective heating
  - *f* is modified Coriolis parameter

$$f^2 = \left(f_c + \frac{2v}{r} \right)\left(f_c + \frac{v}{r} + \frac{\partial v}{\partial r} \right)$$

- *NH* was set to a constant value for the tropical atmosphere
- *v* is crosswind estimate fro
- To check, made same calculation from reconnaissance flight level data (at right)
- Are other storm-centered parameters of interest?



Hurricane Earl – August 30 – Cat 3



Status and Plans

- Calibrated level 1 data now archived
- Plans for selected cases –
  - Precipitation analysis/retrieval (for details, see talk by S. Tanelli)
    - Melting layer classification
    - Precipitation classification (e.g., stratiform)
    - Dual-frequency estimation of precipitation rate and particle size
  - Doppler analysis
    - Compare cross-wind measurements with NOAA/AF measurements
    - Derive products from vertical and cross-wind data (e.g., Rossby length)
- Collaborations – put our measurements in the context of other observations and models